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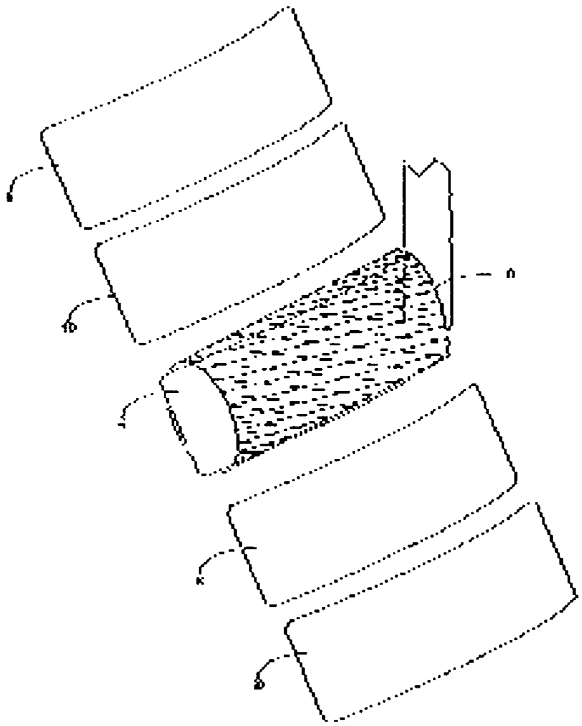
(54) Titre : METHODE DE FABRICATION D'EMBOUT DE BATON DE HOCKEY AVEC ENVELOPPE EN FIBRES TRESSEES
(54) Title: METHOD OF MANUFACTURING A HOCKEY STICK BLADE WITH A BRAIDED FIBER ENVELOPE



(57) Abrégé/Abstract

In this method, a braided fiber envelope is slid over the core of the hockey stick blade and a promoted resin is applied on the core and the fiber envelope. At least one pre-cured reinforcement panel is provided on at least one side of the blade. The resulting assembly is heat pressed so as to secure the reinforcement panel to the blade and shape the blade. A hockey stick shaft constructed in accordance with this method is also disclosed. This construction provides a lighter hockey stick blade with improved mechanical properties compared to previous ones.

ABSTRACT

In this method, a braided fiber envelope is slid over the core of the hockey stick blade and a promoted resin is applied on the core and the fiber envelope. At least one pre-cured reinforcement panel is provided on at least one side of the blade. The resulting assembly is heat pressed so as to secure the reinforcement panel to the blade and shape the blade. A hockey stick shaft constructed in accordance with this method is also disclosed. This construction provides a lighter hockey stick blade with improved mechanical properties compared to previous ones.

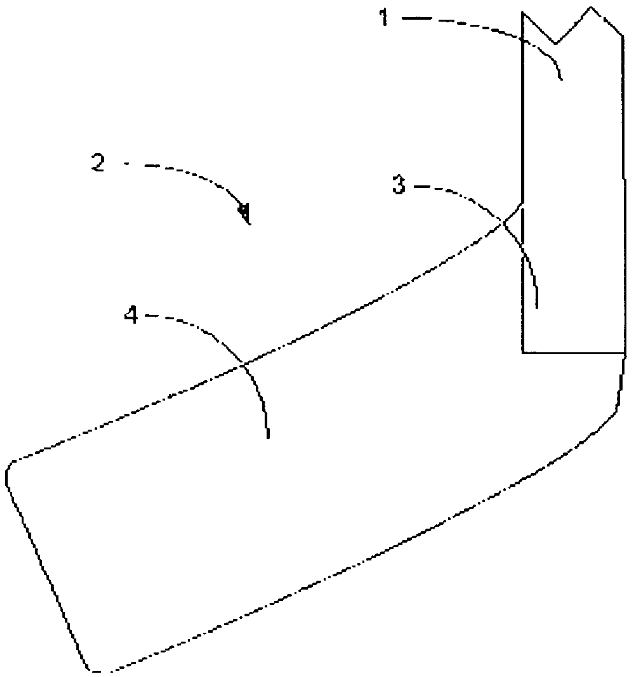


FIG. 1

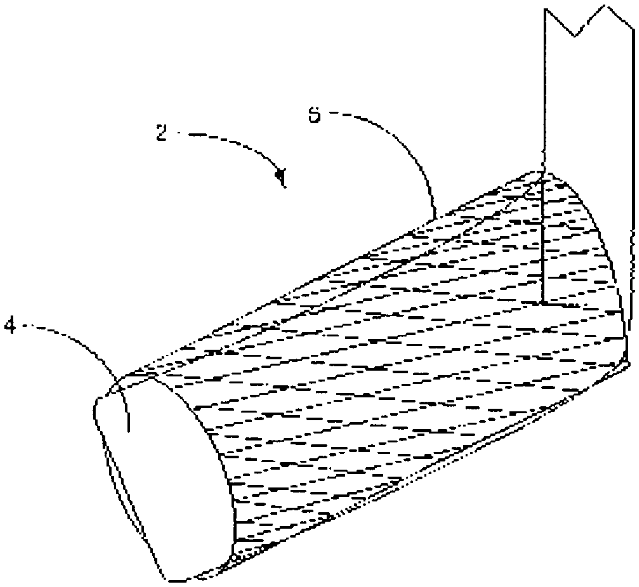


FIG. 2

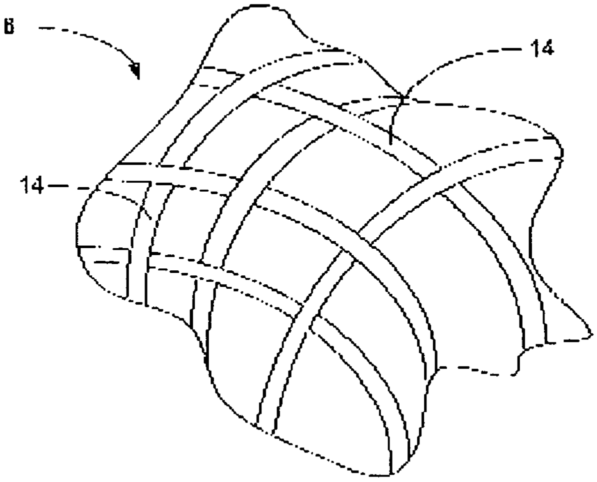


FIG. 3

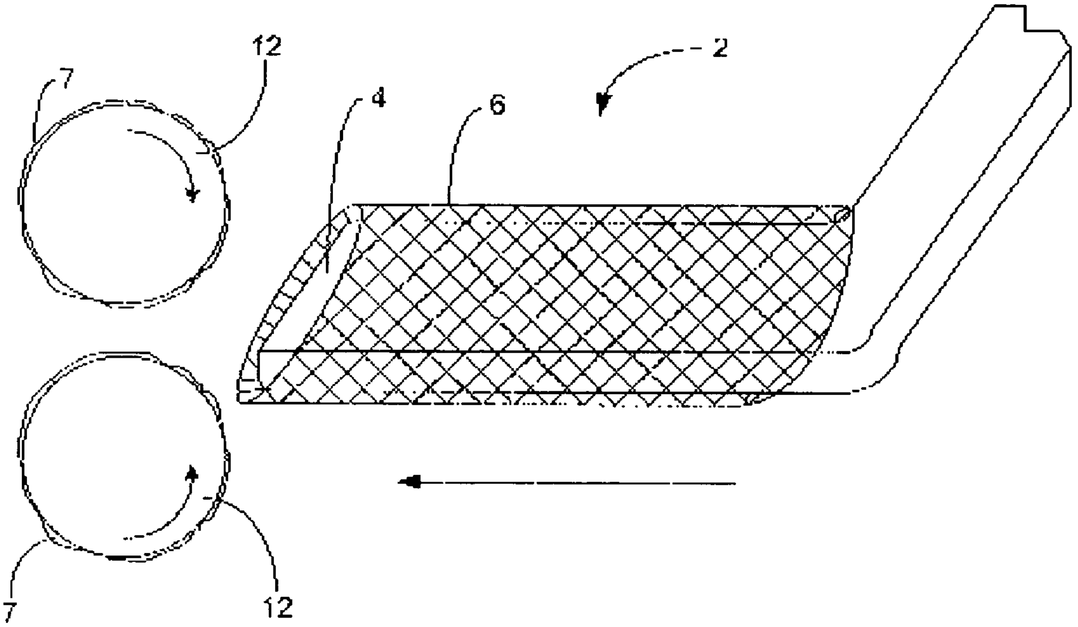


FIG. 4

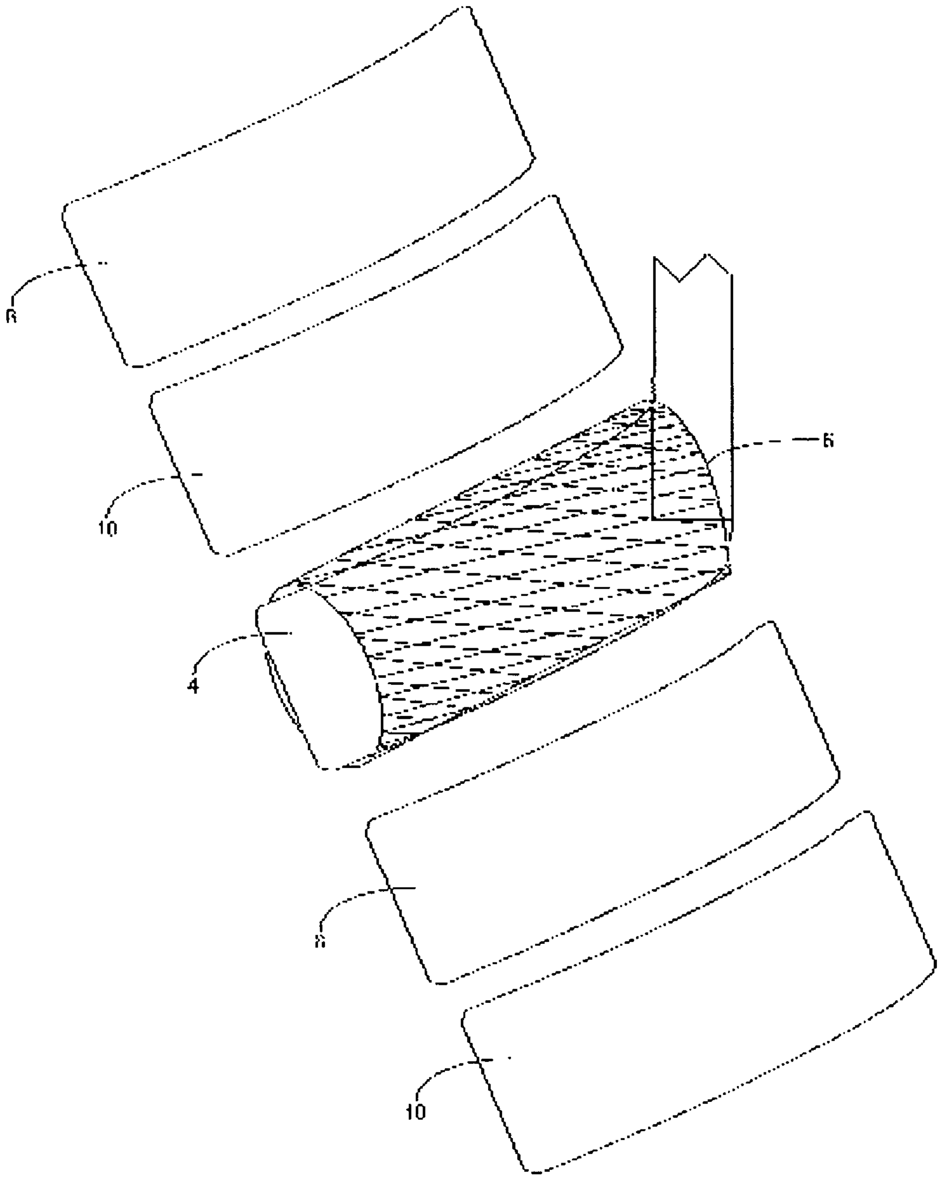


FIG. 5

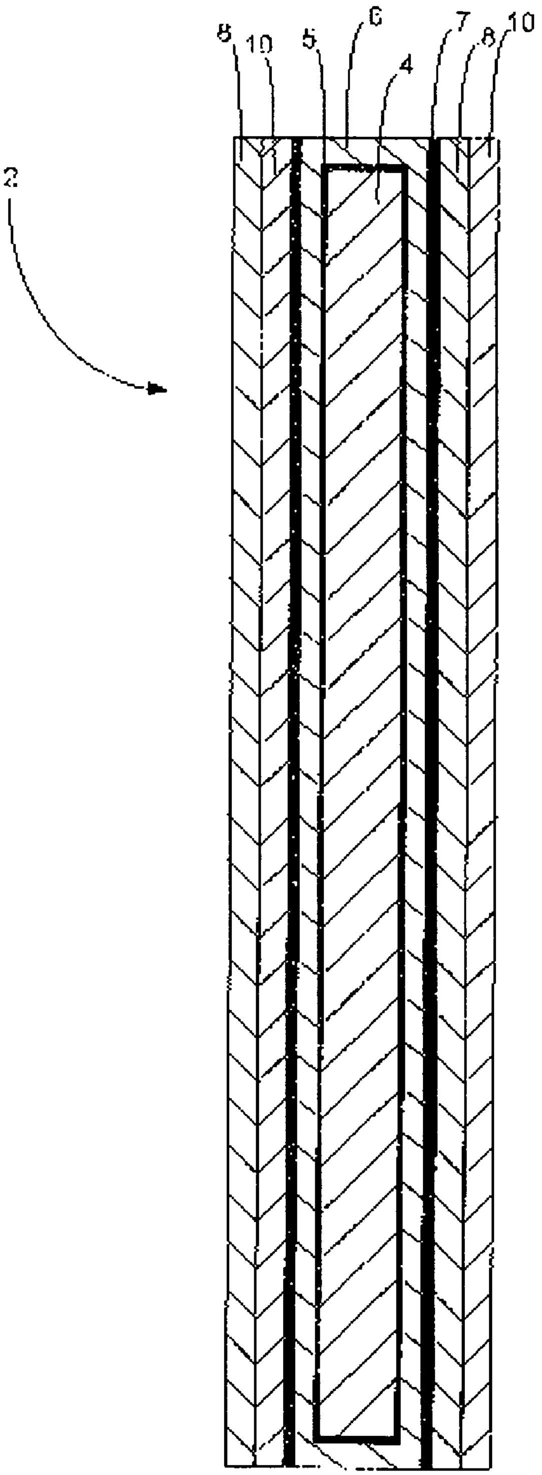


FIG. 6

METHOD OF MANUFACTURING A HOCKEY STICK BLADE WITH A BRAIDED FIBER ENVELOPE

BACKGROUND

Hockey stick blades have traditionally been made using a core to which is glued a hosel, both made of a material such as wood, ABS or polyurethane foam. The core and hosel are then covered by a layer of fleece or fiberglass over which reinforcement panels are fixed using a lamination process. The purpose of the fleece or fiberglass layer is to fill in any space present between the core, the hosel and the reinforcement panels. As part of the laminating process, the blade assembly is pressed to obtain the desired curve. This construction, however, has some drawbacks. One of them is that the fleece layer itself does not improve any substantial mechanical properties of the blade. When a fiberglass layer is used, the problem is that the spacing between the fibers is always very small and the angle between the fibers is fixed. The fiberglass layer material comes in rolls and is thus limited in terms of possible densities and geometries.

Another known construction included the addition of a twilled or plain weaved fiber envelope with a fiberglass layer over a laminated blade assembly in order to improve its mechanical properties. However, the disadvantages of such a construction is the usual presence of wrinkles in the fiber envelope, which lessens its potential added mechanical properties. These wrinkles are caused by the fiber envelope being applied to a blade having an already formed curve combined with the fact that the blade cannot be pressed a second time. A further disadvantage is that the fiber envelope is on the exterior surface of the blade and is exposed to impacts.

Also existing is a construction where dry reinforcement panels are added to the core and hosel, the blade curvature being formed through a resin transfer molding process or vacuum assisted resin transfer molding process. The disadvantages of such a construction is that it requires complex and expensive processes in order to obtain a consistent surface finish. Furthermore, a different mold is required for every blade profile and curvature, which is expensive and means that the blade profile and curvature must be known before starting the process. The cool down period required after the completion of the process is another disadvantage.

SUMMARY

It is an object of the present invention to provide a hockey stick blade which reduces the difficulties and disadvantages of existing processes.

In accordance with one aspect of the present invention, there is provided a method of forming a hockey stick blade, the hockey stick blade having two sides, the method comprising: providing a core, sliding a braided fiber envelope over the core, applying a promoted resin on the core and the fiber envelope, providing at least one pre-cured reinforcement panel to at least one side of the blade and heat pressing the reinforcement panel towards the core so as to secure the reinforcement panel to the blade and shape the blade.

In accordance with another aspect of the present invention, there is provided a hockey stick blade comprising a core, an envelope of braided fiber surrounding the core, a layer of promoted resin on the core and the fiber envelope and at least one reinforcement panel secured on at least one side of the blade.

Other objects, aspects and advantages of the present invention will be found in the following detailed description of a preferred embodiment of the present invention. The description makes reference to the following accompanying figures.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a schematic view of a hockey stick blade core.

FIG. 2 is a schematic view of a braided fiber envelope being slid over the hockey stick blade core.

FIG. 3 is an enlarged view an example of the braided fibers of the envelope.

FIG. 4 is a schematic view of the core with the braided fiber envelope being inserted between rollers.

FIG. 5 is an exploded view of the hockey stick blade.

FIG. 6 is a cross-sectional view of the resulting assembly.

DETAILED DESCRIPTION

As shown in FIG. 1, a blade (2) is the part of a hockey stick located at the lower end of a shaft (1). Both the shaft (1) and the blade (2) are joined together by a hosel (3).

The construction of the blade (2) begins by providing a core (4). The core (4) is preferably connected to the hosel (3) before the other components of the blade (2) are added.

The core (4) may be made of a wide range of materials. Examples are wood, acrylonitrile butadiene styrene (ABS) plastic, polyurethane foam, carbon, fiberglass, aramid, vinyl ester, polyester resins, or a combination of two or more of the preceding. Of course, other materials with similar characteristics may be used as well. The core (4) is preferably initially straight, meaning that it does not have any pronounced curve.

If ABS is used to make the core (4) and hosel (3), then a layer of an acetone based primer (5) is preferably applied to the core (4) and hosel (3) at that stage. For example, the primer (5) can be applied by dipping the core (4) and hosel (3) into the liquid primer (5) or by spraying the primer (5) thereon. The primer (5) is a chemical coating used to soften the ABS surface and promote the bonding to the core (4) and hosel (3) of the other components of the blade (2).

As schematically shown in FIG. 2, an envelope (6) composed of braided fibers is opened and slid onto the core (4) and hosel (3) either manually or mechanically. As best shown in FIG. 3, the braided fibers (14) forming the braided fiber envelope (6) are threaded over and under each other to form a tube. The

The fibers (14) may be made, for example, of carbon or fiberglass. The angle between the crossing fibers (14) and the diameter of the braided fiber envelope (6) are selected to obtain specific mechanical properties, such as stiffness and strength. Commercially available braided fiber envelopes (6) may be ordered with the desired specific parameters. Examples of such commercially available products are the Gammasox^{TM} braided carbon fiber envelope and the Silasox^{TM} braided fiberglass fiber envelope.

Furthermore, the angle between the crossing fibers can be varied locally over the length of the core (4) and hosel (3) in order to obtain various desired mechanical properties. This may be achieved by stretching the fiber braided envelope (6) since the core (4) has not undergone any pressing operation at this stage. It should be noted that the envelope (6) is preferably elastically tighten over the core (4) once set in place, notwithstanding what is shown in the figures.

Once the envelope (6) is in place, a promoted resin (7), such as Araldite^{TM} epoxy, is applied. This is preferably achieved by inserting the core (4), hosel (3) and braided fiber envelope (6) between transfer rollers (12). The promoted resin (7) allows to glue the braided fiber envelope (6) to the core (4) and hosel (3).

A pre-cured reinforcement panel (8) is added to either or both sides of the assembly formed by the core (4), hosel (3) and the braided fiber envelope (6) in order to provide structural support to the blade (2). The reinforcement panel (8) is made, for example, of carbon, fiberglass or Kevlar^{TM}. The expression "pre-cured" refers to the fact that at least one side of the panel (8) is chemically treated with a heat activated adhesive. Furthermore, a pre-cured graphic panel (10), which may be made of similar material as the reinforcement panel (8) or may be in the form of a thin film of a light weight material, may also be applied to either or both sides of the assembly formed by the core (4), hosel (3) and the braided fiber envelope (6). The addition of a graphic panel (10) is for branding or advertisement purposes as well as added impact protection. If present, the reinforcement panels (8) and graphic panels (10) may be added to the assembly in any order desired. In the case where a graphic panel (10) is placed under a reinforcement panel (8), the overlaying reinforcement panel (8) may be transparent so as to permit the viewing of the graphic panel (10).

Once assembled, the blade (2) is heated and pressed in order to complete the laminating process and obtain the desired blade curvature. The desired blade curvature is obtained by selecting appropriately shaped plates for the press. Finally, the blade (2) is sanded and machined to obtain the required profile.

The resulting construction of the blade (2) according to the preferred embodiment of the present invention is shown in FIG. 6. Although the primer (5) and the promoted resin (7) are shown in FIG. 6 as distinct layers disposed in the order in which they are preferably applied, it should be noted that in the primer (5) if any, and the promoted resin (7) are impregnated within the fiber braided envelope (6). The thickness of the various layers are also exagerated for the purpose of illustration. As can be appreciated, this construction results in the core (4) and the braided fiber envelope (6) being protected by one or more reinforcement panels (8), and possibly by graphic panels (10), all of which provides higher stiffness to weight ratio than in the prior art constructions. This is due to the fact that in the prior art a twilled or plain weaved fiber envelope was added over the reinforcement panel (8), requiring a layer of fleece or fiberglass to fill any space between the core, the hosel and the reinforcement panel. The fleece adds no mechanical properties to the blade while the fiberglass only adds minimal mechanical properties. Furthermore, the braiding in the present invention has better mechanical properties of the fibers than a twill or weave. Since the fiber braided envelope (6) and promoted resin (7) are applied between the core (4), the hosel (3) and the reinforcement panel (8), no additional filler, such as fleece or fiberglass, is needed. Overall, this provides for a lighter blade with improved mechanical properties.

WHAT IS CLAIMED IS:

1. A method of forming a hockey stick blade, the hockey stick blade having two sides, the method comprising:

   a) providing a core;

   b) sliding a braided fiber envelope over the core;

   c) applying a promoted resin on the core and the fiber envelope;

   d) providing at least one pre-cured reinforcement panel to at least one side of the blade; and

   e) heat pressing the reinforcement panel towards the core so as to secure the reinforcement panel to the blade and shape the blade.

2. A method according to claim 1, wherein in a), the core is straight.

3. A method according to claim 1, further comprising, between a) and b) :

   applying a primer on the core.

4. A method according to claim 1, wherein the promoted resin is applied using transfer rollers.

5. A method according to claim 1, further comprising, between c) and d) :

   providing at least one pre-cured graphic panel over the reinforcement panel.

6. A method according to claim 1, further comprising, between d) and e) :

   providing at least one pre-cured graphic panel to at least one side of the blade, the reinforcement panel being provided over the graphic panel.

7. A method according to claim 1, further comprising, after e) :

sanding and profiling the blade.

8. A method according to claim 1, wherein in c), the fiber braided envelope comprises fibers threaded over and under each other.

9. A method according to claim 8, wherein in c), the fiber braided envelope is stretched locally so as to modify the angle between the fibers.

10. A hockey stick blade having two sides, the blade comprising:

a core;

an envelope of braided fiber surrounding the core;

a layer of promoted resin between the core and the fiber envelope; and

at least one reinforcement panel secured on at least one side of the blade;

whereby the core, the envelope of braided fiber, the promoted resin and the reinforcement panel are provided before the hockey stick blade is heat pressed and shaped.

11. A hockey stick blade according to claim 10, further comprising a layer of primer between the core and the layer of promoted resin.

12. A hockey stick blade according to claim 10, further comprising at least one graphic panel secured over the reinforcement panel.

13. A hockey stick blade according to claim 10, further comprising at least one graphic panel on at least one side of the blade, the reinforcement panel being secured over the graphic panel.

14. A hockey stick blade according to claim 13, wherein the reinforcement panel is made of a transparent material.

15. A hockey stick blade according to claim 10, wherein the fiber braided envelope comprises fibers threaded over and under each other.

16. A hockey stick blade according to claim 15, wherein the fiber braided envelope is stretched locally so as to modify the angle between the fibers.